

March 2010

BS170 / MMBF170
N-Channel Enhancement Mode Field Effect Transistor

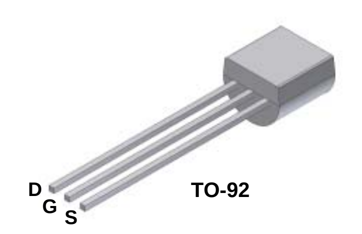
General Description

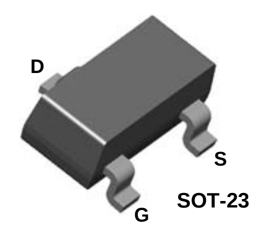
These N-Channel enhancement mode field effect transistors are produced using Fairchild's proprietary, high cell density, DMOS technology. These products have been designed to minimize on-state resistance while provide rugged, reliable, and fast switching performance. They can be used in most applications requiring up to 500mA DC. These products are particularly suited for low voltage, low current applications such as small servo motor control, power MOSFET gate drivers, and other switching applications.

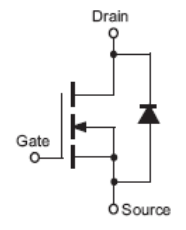
Features

- High density cell design for low $R_{DS(ON)}$.
- Voltage controlled small signal switch.
- Rugged and reliable.
- High saturation current capability.

BS170 **MMBF170**







Absolute Maximum Ratings T_A = 25°C unless otherwise noted

Symbol	Parameter	BS170	MMBF170	Units
V_{DSS}	Drain-Source Voltage	60		V
V_{DGR}	Drain-Gate Voltage ($R_{GS} \leq 1M\Omega$)	60		V
V_{GSS}	Gate-Source Voltage	± 20		V
I_D	Drain Current - Continuous	500	500	mA
	- Pulsed	1200	800	
T_J, T_{STG}	Operating and Storage Temperature Range	- 55 to 150		°C
T_L	Maximum Lead Temperature for Soldering Purposes, 1/16" from Case for 10 Seconds	300		°C

Thermal Characteristics T_A = 25°C unless otherwise noted

Symbol	Parameter	BS170	MMBF170	Units
P_D	Maximum Power Dissipation Derate above 25°C	830 6.6	300 2.4	mW mW/°C
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	150	417	°C/W

Electrical Characteristics T_A=25°C unless otherwise noted

Symbol	Parameter	Conditions	Type	Min.	Typ.	Max.	Units
OFF CHARACTERISTICS							
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0V, I_D = 100μA	All	60			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 25V, V_{GS} = 0V	All			0.5	μA
I_{GSSF}	Gate - Body Leakage, Forward	V_{GS} = 15V, V_{DS} = 0V	All			10	nA
ON CHARACTERISTICS (Notes 1)							
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 1mA	All	0.8	2.1	3	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS} = 10V, I_D = 200mA	All		1.2	5	Ω
g_{FS}	Forward Transconductance	V_{DS} = 10V, I_D = 200mA	BS170		320		mS
		V_{DS} ≥ 2 $V_{DS(on)}$, I_D = 200mA	MMBF170		320		
Dynamic Characteristics							
C_{iss}	Input Capacitance	V_{DS} = 10V, V_{GS} = 0V, f = 1.0MHz	All		24	40	pF
C_{oss}	Output Capacitance		All		17	30	pF
C_{rss}	Reverse Transfer Capacitance		All		7	10	pF
Switching Characteristics (Notes 1)							
t_{on}	Turn-On Time	V_{DD} = 25V, I_D = 200mA, V_{GS} = 10V, R_{GEN} = 25Ω	BS170			10	ns
		V_{DD} = 25V, I_D = 500mA, V_{GS} = 10V, R_{GEN} = 50Ω	MMBF170			10	
t_{off}	Turn-Off Time	V_{DD} = 25V, I_D = 200mA, V_{GS} = 10V, R_{GEN} = 25Ω	BS170			10	ns
		V_{DD} = 25V, I_D = 500mA, V_{GS} = 10V, R_{GEN} = 50Ω	MMBF170			10	

Note:
1. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2.0%.

Ordering Information

Part Number	Package	Package Type	Lead Frame	Pin array
BS170	TO-92	BULK	STRAIGHT	D G S
BS170_D26Z	TO-92	Tape and Reel	FORMING	D G S
BS170_D27Z	TO-92	Tape and Reel	FORMING	D G S
BS170_D74Z	TO-92	AMMO	FORMING	D G S
BS170_D75Z	TO-92	AMMO	FORMING	D G S
MMBF170	SOT-23	Tape and Reel		

Typical Electrical Characteristics

BS170 / MMBF170

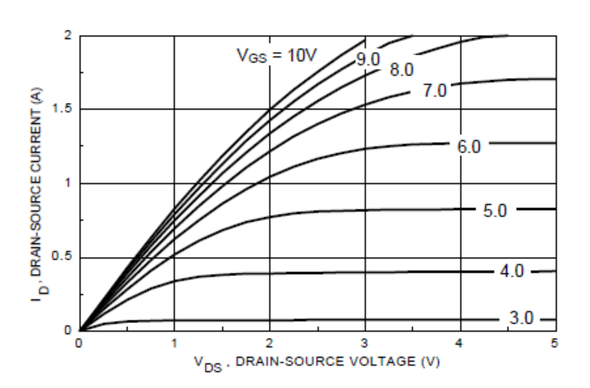


Figure 1. On-Region Characteristics.

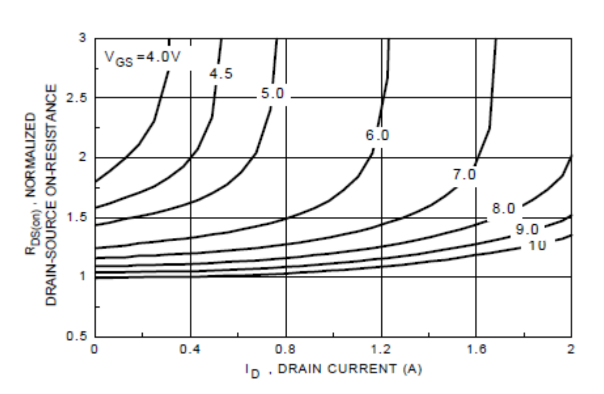


Figure 2. On-Resistance Variation with Gate Voltage and Drain Current.

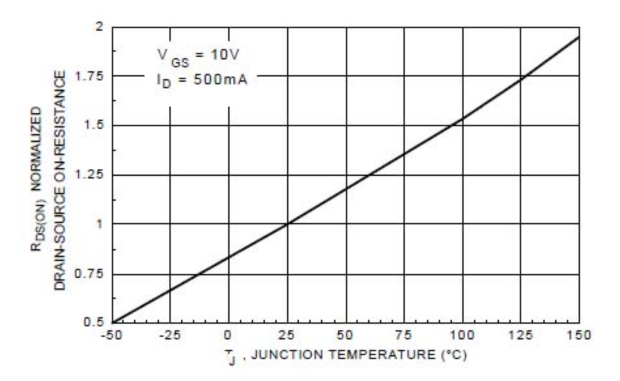


Figure 3. On-Resistance Variation with Temperature.

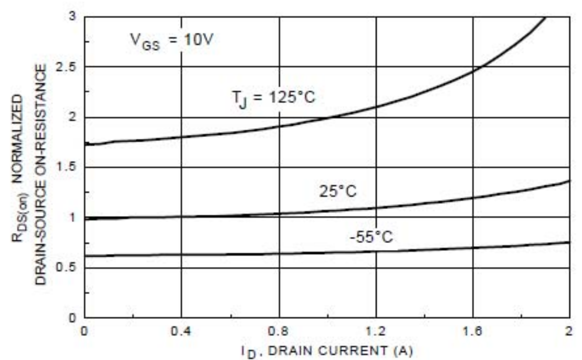


Figure 4. On-Resistance Variation with Drain Current and Temperature.

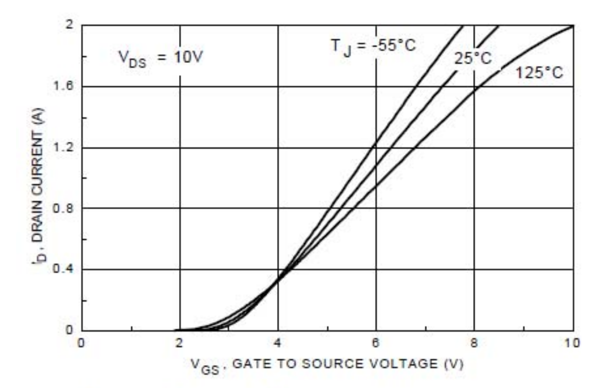


Figure 5. Transfer Characteristics.

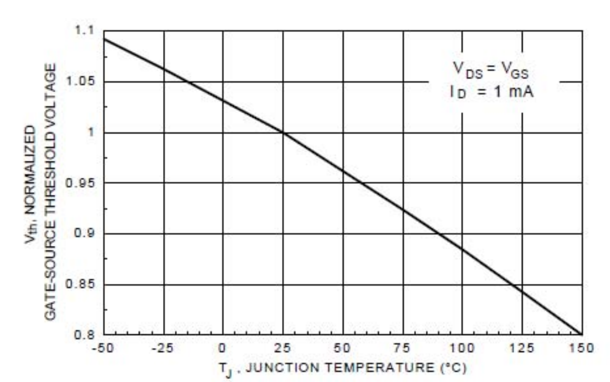


Figure 6. Gate Threshold Variation with Temperature.

Typical Electrical Characteristics (continued)

BS170 / MMBF170

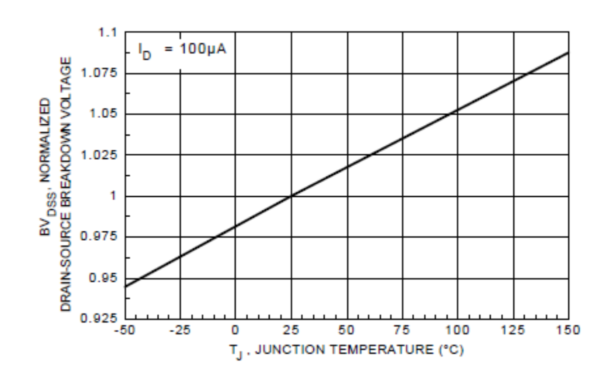


Figure 7. Breakdown Voltage Variation with Temperature.

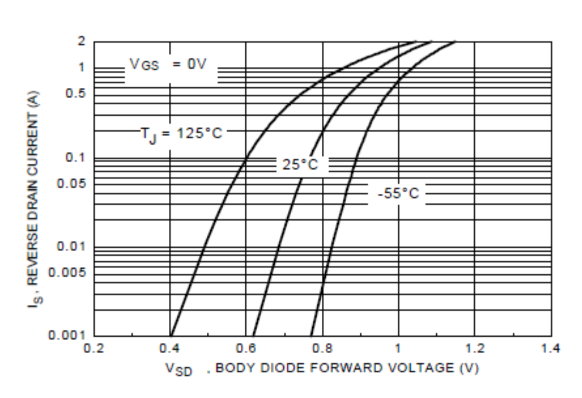


Figure 8. Body Diode Forward Voltage Variation with Current and Temperature.

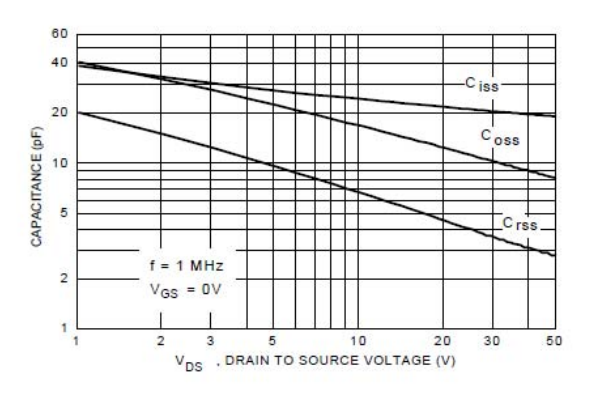


Figure 9. Capacitance Characteristics.

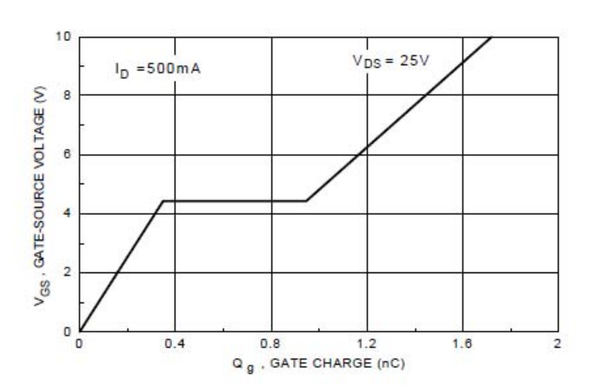


Figure 10. Gate Charge Characteristics.

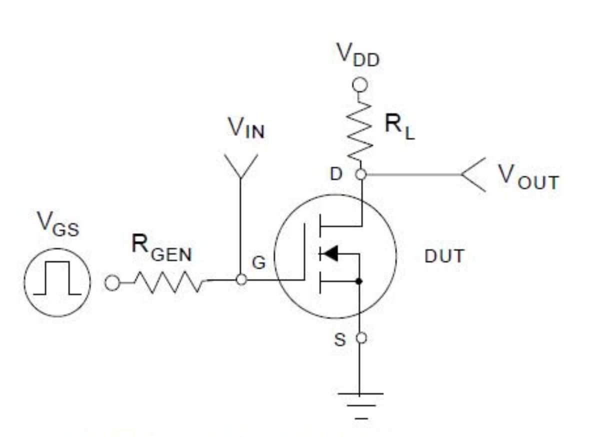


Figure 11. Switching Test Circuit.

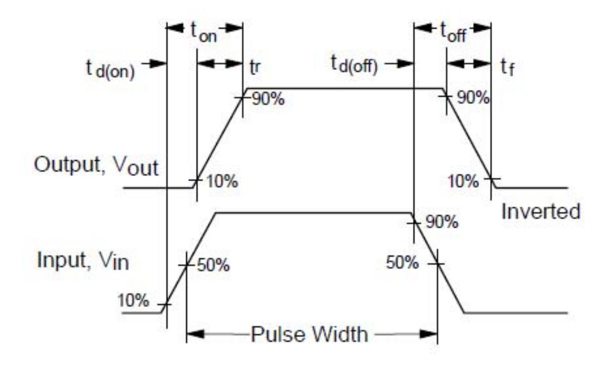


Figure 12. Switching Waveforms.

Typical Electrical Characteristics (continued)

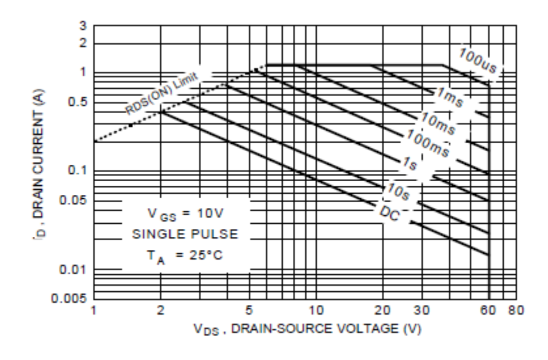


Figure 13. BS170 Maximum Safe Operating Area.

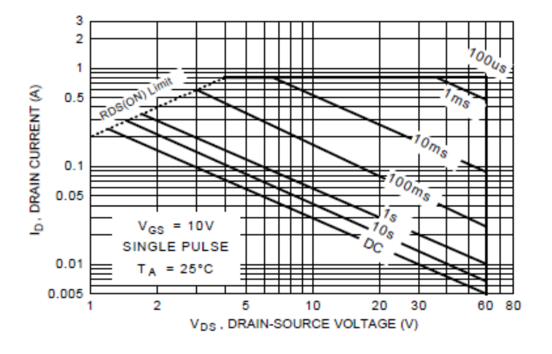


Figure 14. MMBF170 Maximum Safe Operating Area.

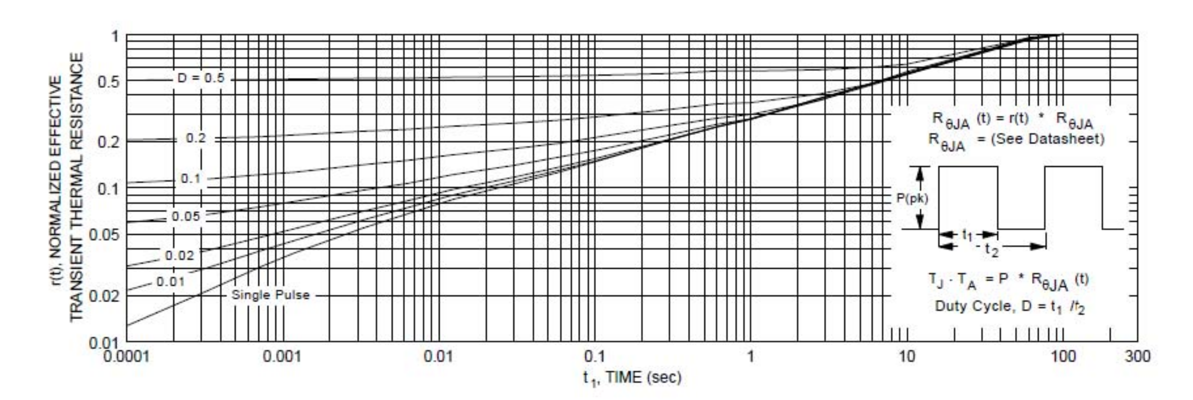


Figure 15. TO-92, BS170 Transient Thermal Response Curve.

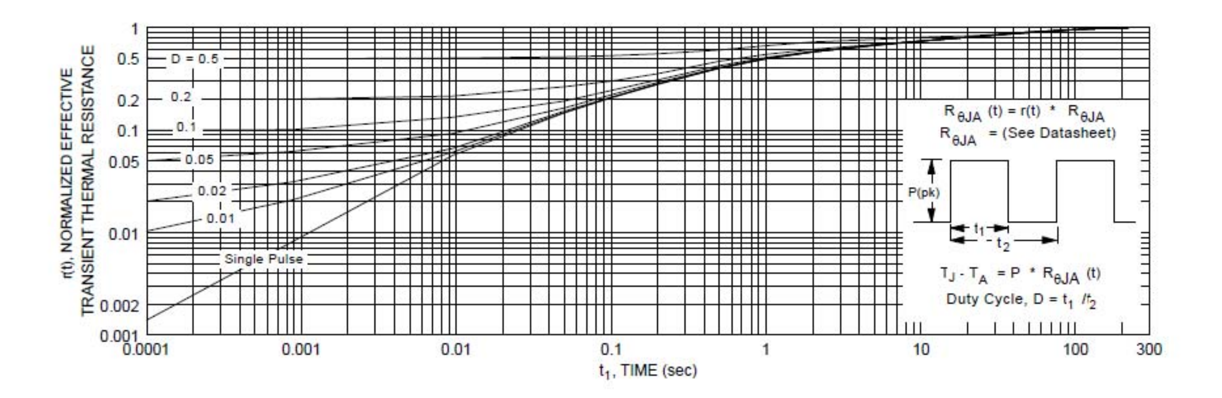
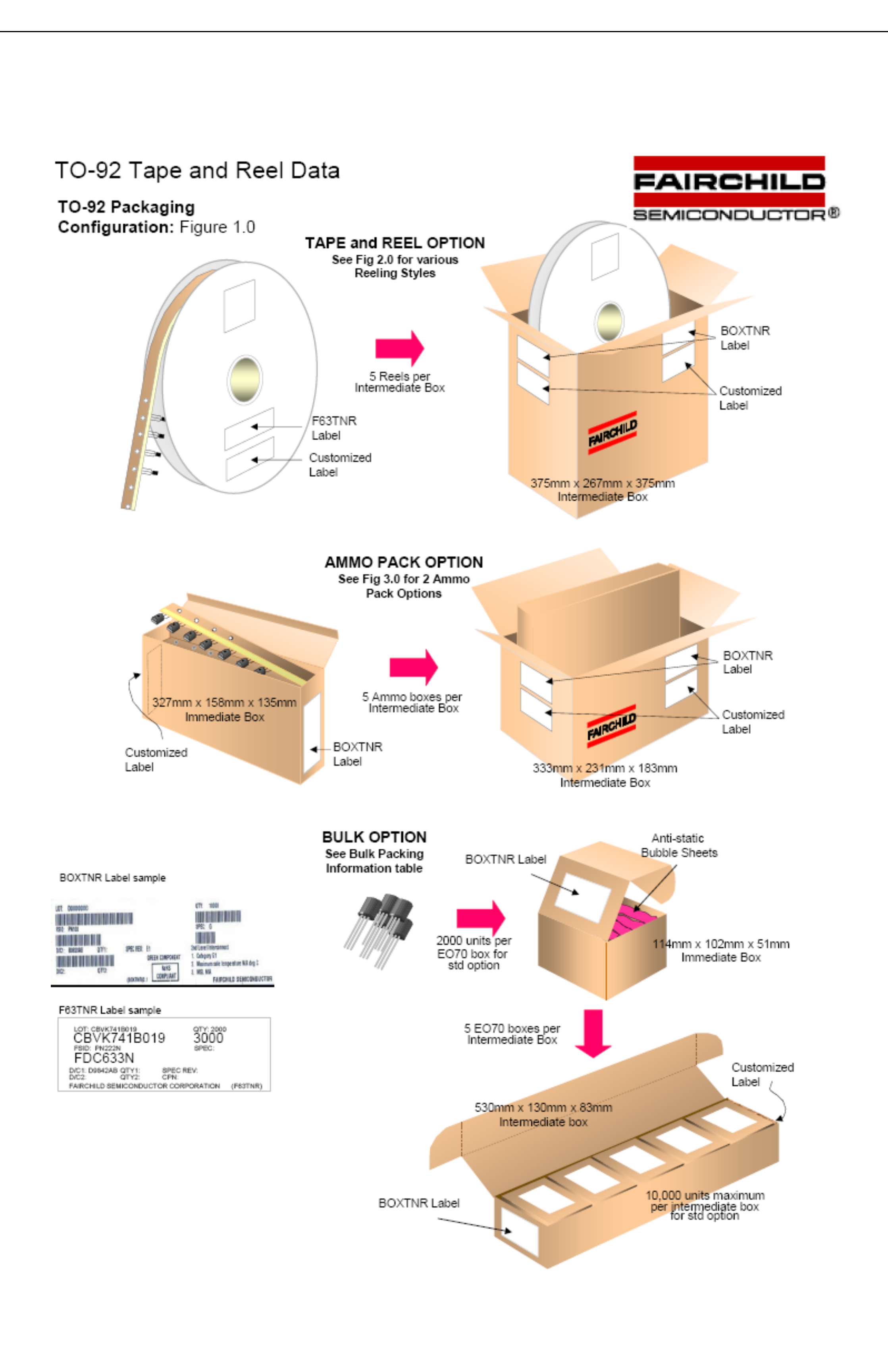


Figure 16. SOT-23, MMBF170 Transient Thermal Response Curve.



TO-92 Tape and Reel Data
FAIRCHILD
SEMICONDUCTOR®
TO-92 Packaging
Configuration: Figure 1.0
TAPE and REEL OPTION
See Fig 2.0 for various Reeling Styles
5 Reels per Intermediate Box
F63TNR Label
Customized Label
BOXTNR Label
Customized Label
FAIRCHILD
375mm x 267mm x 375mm Intermediate Box
AMMO PACK OPTION
See Fig 3.0 for 2 Ammo Pack Options
327mm x 158mm x 135mm Immediate Box
Customized Label
BOXTNR Label
5 Ammo boxes per Intermediate Box
BOXTNR Label
Customized Label
FAIRCHILD
333mm x 231mm x 183mm Intermediate Box
BULK OPTION
See Bulk Packing Information table
BOXTNR Label sample
F63TNR Label sample
LOT: CBVK741B019
CBVK741B019
QTY: 2000
3000
FSID: PN222N
SPEC:
FDC633N
D/C1: D9842AB QTY1:
SPEC REV:
D/C2:
QTY2:
CPN:
FAIRCHILD SEMICONDUCTOR CORPORATION
(F63TNR)
2000 units per EO70 box for std option
BOXTNR Label
Anti-static Bubble Sheets
114mm x 102mm x 51mm Immediate Box
5 EO70 boxes per Intermediate Box
Customized Label
530mm x 130mm x 83mm Intermediate box
BOXTNR Label
10,000 units maximum per intermediate box for std option

TO-92 Tape and Reel Data, continued



TO-92 Packing
Information: Figure 2.0

TO-92 TNR/AMMO PACKING INFORMATION TABLE

Packing	Style	Quantity	EOL code
Reel	A	2,000	D26Z
	B	2,000	D11Z
	C	2,000	D28Z
	D	2,000	D10Z
	E	2,000	D27Z
	F	2,000	D81Z
	G	2,000	D29Z
	H	2,000	D89Z
Ammo	M	2,000	D74Z
	P	2,000	D75Z

Unit weight = 0.22 gm
Reel weight with components = 1.04 kg
Ammo weight with components = 1.02 kg
Max quantity per intermediate box = 10,000 units

TO-92 BULK PACKING INFORMATION TABLE

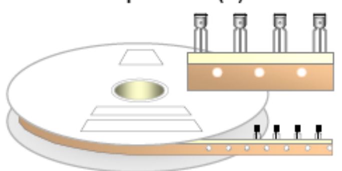
EOL CODE / FLOW OPTION	DESCRIPTION	LEADCLIP DIMENSION	MINIMUM ORDER QTY	LEADFORM OULTINE
NO EOL CODE	STRAIGHT LEADS	NO LEAD CLIP	2.0K / BOX	
J18Z	TO-18 OPTION STD	NO LEAD CLIP	2.0K / BOX	
J35Z	TO-18 OPTION REVERSE	NO LEAD CLIP	2.0K / BOX	
J05Z	TO-5 OPTION STD	NO LEAD CLIP	1.5K / BOX	
J60Z	TO-5 OPTION REVERSE	NO LEAD CLIP	1.5K / BOX	
J61Z	IN LINE 0.200 SPACING	NO LEAD CLIP	1.5K / BOX	



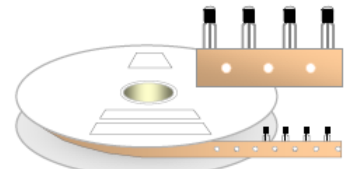
TO-92 Tape and Reel Data, continued

TO-92 Reeling Style
Configuration: Figure 3.0

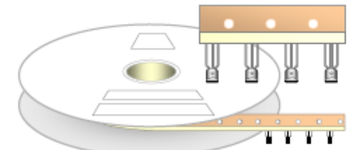
Machine Option "A" (H)



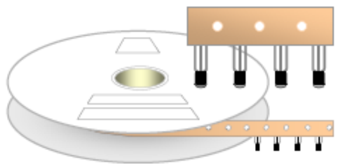
Style "A", D26Z



Style "B", D11Z

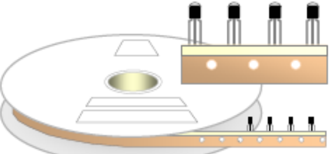


Style "C", D28Z

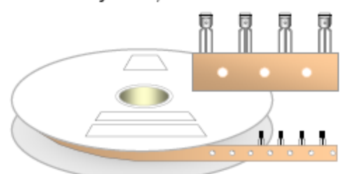


Style "D", D10Z

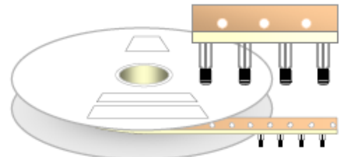
Machine Option "E" (J)



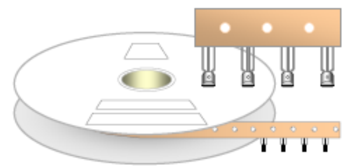
Style "E", D27Z



Style "F", D81Z

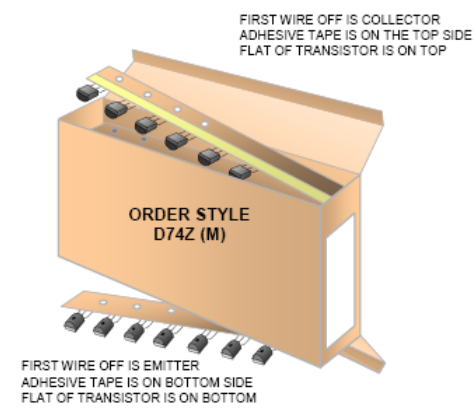


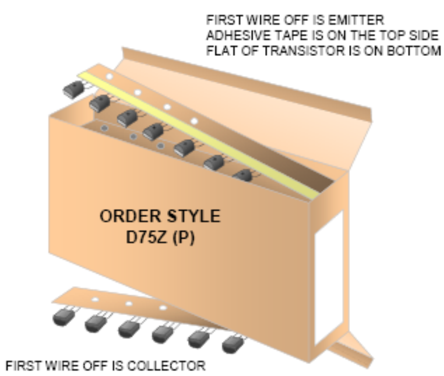
Style "G", D29Z



Style "H", D89Z

TO-92 Radial Ammo Packaging
Configuration: Figure 4.0

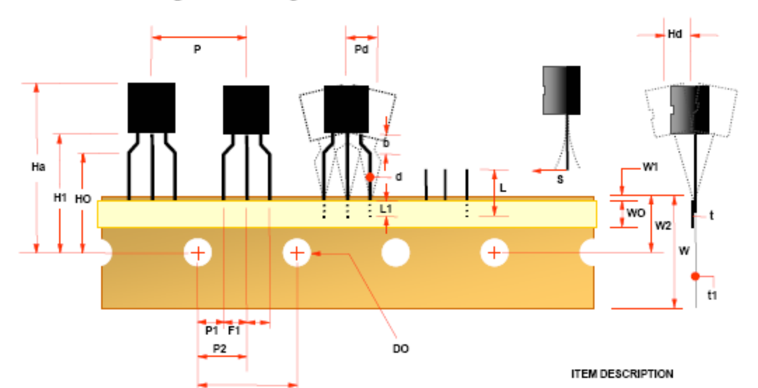




TO-92 Tape and Reel Data, continued



TO-92 Tape and Reel Taping
Dimension Configuration: Figure 5.0

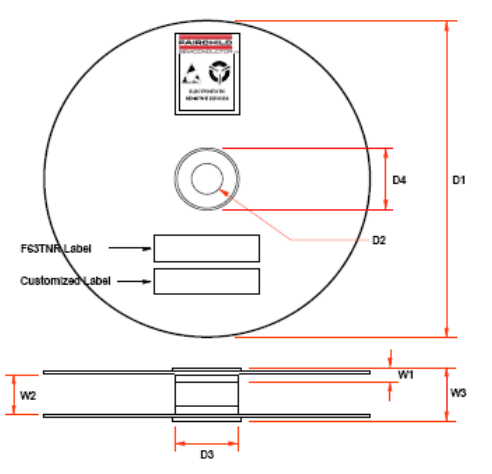


User Direction of Feed

ITEM DESCRIPTION	SYMBOL	DIMENSION
Base of Package to Lead Bend	b	0.098 (max)
Component Height	Ha	0.928 (+/- 0.025)
Lead Clinch Height	HO	0.630 (+/- 0.020)
Component Base Height	H1	0.748 (+/- 0.020)
Component Alignment (side/side)	Pd	0.040 (max)
Component Alignment (front/back)	Hd	0.031 (max)
Component Pitch	P	0.500 (+/- 0.020)
Feed Hole Pitch	PO	0.500 (+/- 0.008)
Hole Center to First Lead	P1	0.150 (+0.009, -0.010)
Hole Center to Component Center	P2	0.247 (+/- 0.007)
Lead Spread	F1/F2	0.104 (+/- 0 .010)
Lead Thickness	d	0.018 (+0.002, -0.003)
Cut Lead Length	L	0.429 (max)
Taped Lead Length	L1	0.209 (+0.051, -0.052)
Taped Lead Thickness	t	0.032 (+/- 0.006)
Carrier Tape Thickness	t1	0.021 (+/- 0.006)
Carrier Tape Width	W	0.708 (+0.020, -0.019)
Hold - down Tape Width	WO	0.236 (+/- 0.012)
Hold - down Tape position	W1	0.035 (max)
Feed Hole Position	W2	0.360 (+/- 0.025)
Sprocket Hole Diameter	DO	0.157 (+0.008, -0.007)
Lead Spring Out	S	0.004 (max)

Note : All dimensions are in inches.

TO-92 Reel
Configuration: Figure 6.0

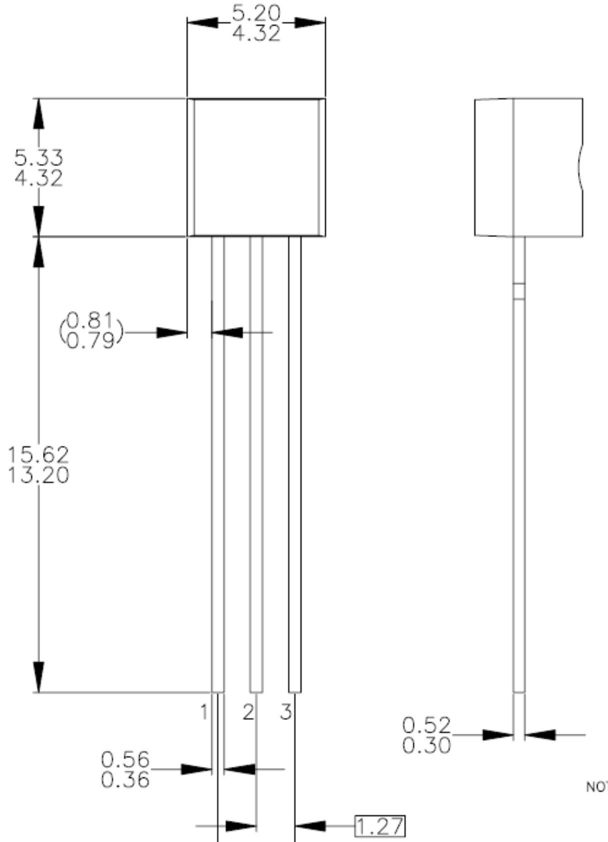


ITEM DESCRIPTION	SYMBOL	MINIMUM	MAXIMUM
Reel Diameter	D1	13.975	14.025
Arbor Hole Diameter (Standard)	D2	1.160	1.200
(Small Hole)	D2	0.650	0.700
Core Diameter	D3	3.100	3.300
Hub Recess Inner Diameter	D4	2.700	3.100
Hub Recess Depth	W1	0.370	0.570
Flange to Flange Inner Width	W2	1.630	1.690
Hub to Hub Center Width	W3		2.090

Note: All dimensions are inches

Mechanical Dimensions (TO-92)

TO-92

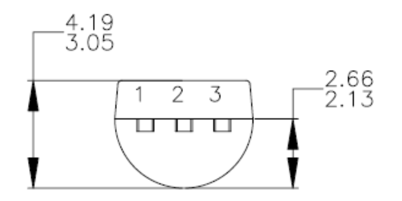


NOTES: UNLESS OTHERWISE SPECIFIED

A) DRAWING WITH REFERENCE TO JEDEC TO−92 RECOMMENDATIONS.
B) ALL DIMENSIONS ARE IN MILLIMETERS.
C) DRAWING CONFORMS TO ASME Y14.5M−1994.
D) TO−92 (92,94,96,97,98) PIN CONFIGURATION:

PIN	92			94			96			97			98		
	P	F	M	P	F	M	P	F	M	P	F	M	P	F	M
1	E	S	S	E	S	S	B	D	G	C	G	D	C	G	D
2	B	D	G	C	G	D	E	S	S	B	D	G	E	S	S
3	C	G	D	B	D	G	C	G	D	E	S	S	B	D	G

LEGEND:
P − BIPOLAR
F − JFET
M − DMOS
E − EMITTER
B − BASE
C − COLLECTOR
D − DRAIN
S − SOURCE
G − GATE



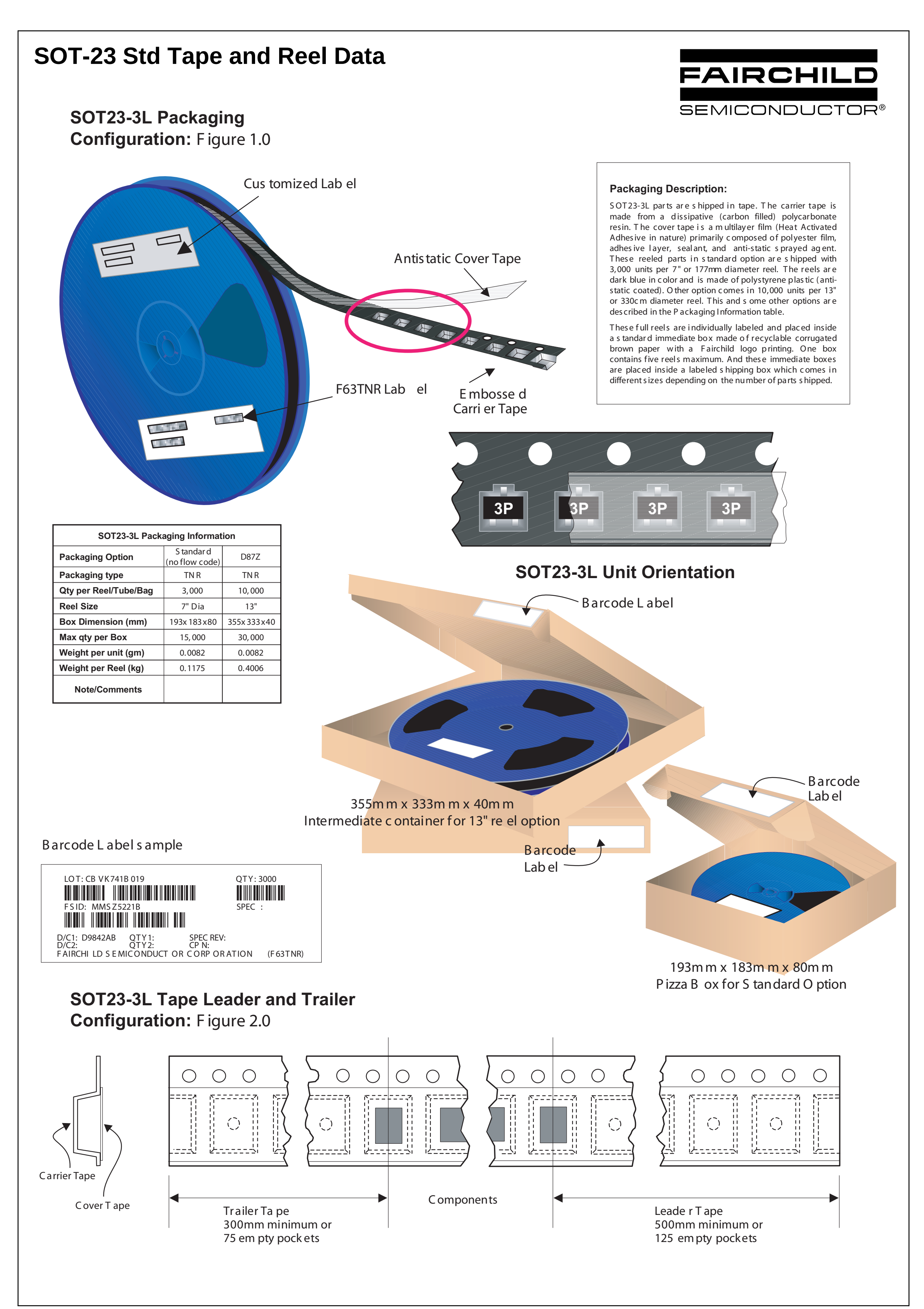
E) FOR PACKAGE 92, 94, 96, 97 AND 98: PIN CONFIGURATION DRAIN "D" AND SOURCE "S" ARE INTERCHANGEAGLE AT JFET "F" OPTION.
F) DRAWING FILENAME: MKT−ZA03DREV3.

Dimensions in Millimeters

SOT-23 Std Tape and Reel Data

SOT23-3L Packaging

Configuration: Figure 1.0



Packaging Description:

SOT23-3L parts are shipped in tape. The carrier tape is made from a dissipative (carbon filled) polycarbonate resin. The cover tape is a multilayer film (Heat Activated Adhesive in nature) primarily composed of polyester film, adhesive layer, sealant, and anti-static sprayed agent. These reeled parts in standard option are shipped with 3,000 units per 7" or 177mm diameter reel. The reels are dark blue in color and is made of polystyrene plastic (anti-static coated). Other option comes in 10,000 units per 13" or 330cm diameter reel. This and some other options are described in the Packaging Information table.

These full reels are individually labeled and placed inside a standard immediate box made of recyclable corrugated brown paper with a Fairchild logo printing. One box contains five reels maximum. And these immediate boxes are placed inside a labeled shipping box which comes in different sizes depending on the number of parts shipped.

SOT23-3L Packaging Information

Packaging Option	Standard (no flow code)	D87Z
Packaging type	TNR	TNR
Qty per Reel/Tube/Bag	3,000	10,000
Reel Size	7" Dia	13"
Box Dimension (mm)	193x183x80	355x333x40
Max qty per Box	15,000	30,000
Weight per unit (gm)	0.0082	0.0082
Weight per Reel (kg)	0.1175	0.4006
Note/Comments		

SOT23-3L Tape Leader and Trailer

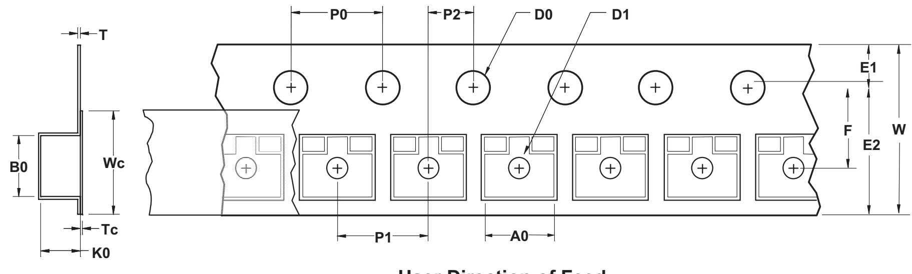
Configuration: Figure 2.0

SOT-23 Std Tape and Reel Data, continued



SOT23-3L Embossed Carrier Tape

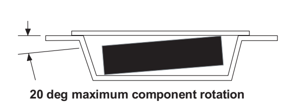
Configuration: Figure 3.0



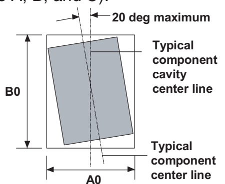
User Direction of Feed

Dimensions are in millimeter													
Pkg type	A0	B0	W	D0	D1	E1	E2	F	P1	P0	K0	T	Wc	Tc
SOT-23 (8mm)	3.15 +/-0.10	2.77 +/-0.10	8.0 +/-0.3	1.55 +/-0.05	1.125 +/-0.125	1.75 +/-0.10	6.25 min	3.50 +/-0.05	4.0 +/-0.1	4.0 +/-0.1	1.30 +/-0.10	0.228 +/-0.013	5.2 +/-0.3	0.06 +/-0.02

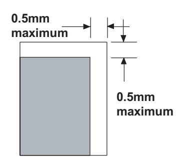
Notes: A0, B0, and K0 dimensions are determined with respect to the EIA/Jedec RS-481 rotational and lateral movement requirements (see sketches A, B, and C).



Sketch A (Side or Front Sectional View)
Component Rotation

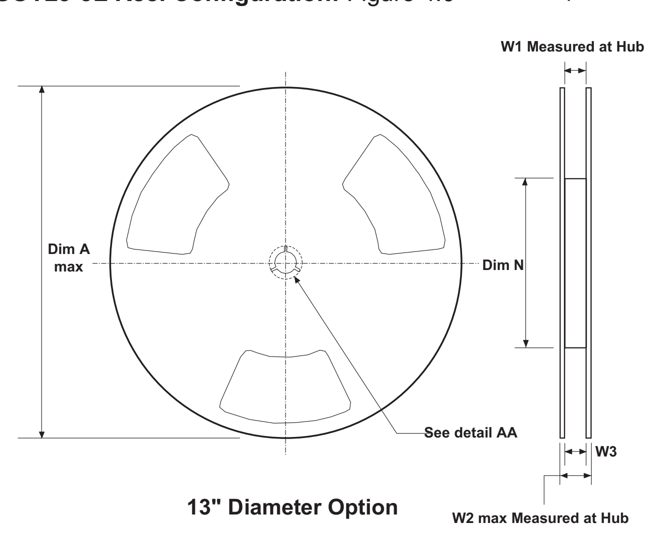


Sketch B (Top View)
Component Rotation

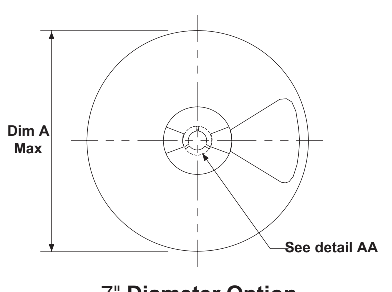


Sketch C (Top View)
Component lateral movement

SOT23-3L Reel Configuration: Figure 4.0



13" Diameter Option



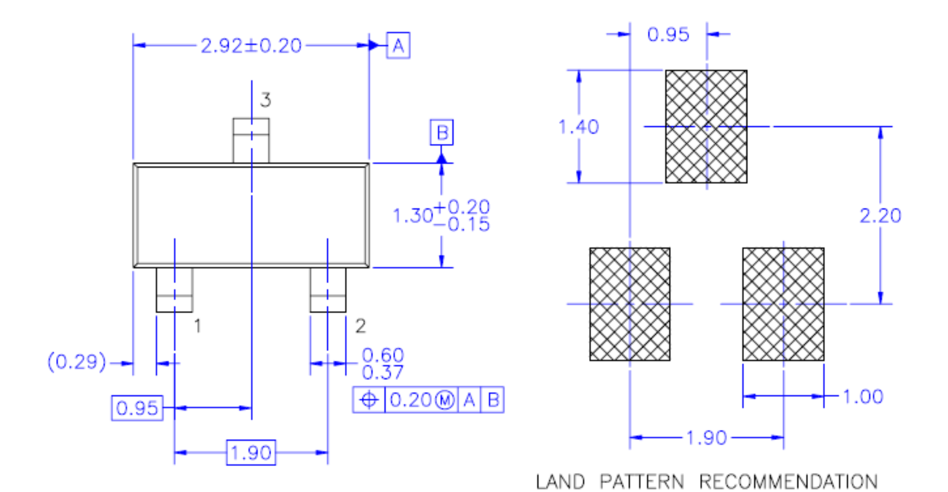
7" Diameter Option

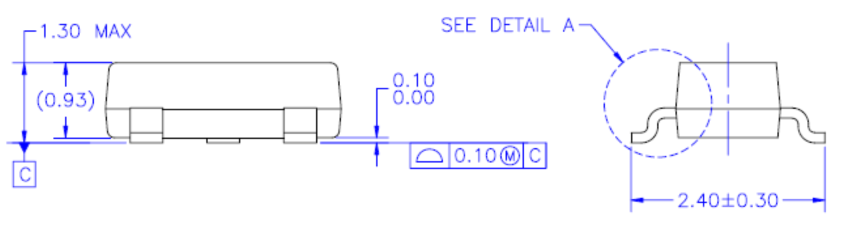
B Min
Dim C
Dim D min
DETAIL AA

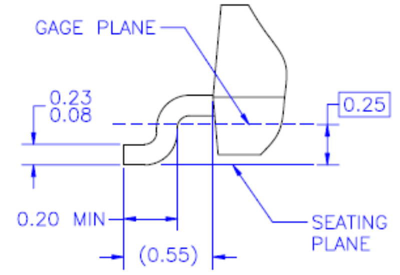
Dimensions are in inches and millimeters									
Tape Size	Reel Option	Dim A	Dim B	Dim C	Dim D	Dim N	Dim W1	Dim W2	Dim W3 (LSL-USL)
8mm	7" Dia	7.00 177.8	0.059 1.5	512 +0.020/-0.008 13 +0.5/-0.2	0.795 20.2	2.165 55	0.331 +0.059/-0.000 8.4 +1.5/0	0.567 14.4	0.311 - 0.429 7.9 - 10. 9
8mm	13" Dia	13.00 330	0.059 1.5	512 +0.020/-0.008 13 +0.5/-0.2	0.795 20.2	4.00 100	0.331 +0.059/-0.000 8.4 +1.5/0	0.567 14.4	0.311 - 0.429 7.9 - 10. 9

Mechanical Dimensions (SOT-23)

SOT-23







DETAIL A
SCALE: 2X

NOTES: UNLESS OTHERWISE SPECIFIED

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B) ALL DIMENSIONS ARE IN MILLIMETERS.
C) DIMENSIONS ARE INCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR EXTRUSIONS.
D) DIMENSIONING AND TOLERANCING PER ASME Y14.5M – 1994.
E) DRAWING FILE NAME: MA03DREV9

Dimensions in Millimeters



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